



Authorizations and Permits for Protected Species (APPS)

File #: 22187

Title: Physiological, behavioral, and ecological stu

Applicant Information

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Project Information

File Number: 22187
Application Status: **Application Complete - Issued**
Project Title: Physiological, behavioral, and ecological studies of northern elephant seals (*Mirounga angustirostris*) in Central California
Project Status: New
Previous Federal or State Permit: 18523
Permit Requested:

- MMPA Research/Enhancement permit

Where will activities occur? California (including offshore waters)
US Locations including offshore waters
Research Timeframe: **Start:** 04/10/2018 **End:** 03/31/2024

Sampling Season/Project Duration:	The proposed research would focus primarily on northern elephant seals at the Piedras Blancas Rookery in San Simeon, CA, but would also include new pupping beaches at Vandenberg AFB. Research would be conducted year-round on all age classes, with increased frequency and effort during the breeding season (December-April). The duration of the requested permit is five years.
Abstract:	<p>Northern elephant seals (<i>Mirounga angustirostris</i>; NES) are a well-studied model species for pinniped physiology and behavior, but their biology is only well known for part of their range. Piedras Blancas (PB), in Central California, is the site of the largest mainland colony of NES, yet no formal population monitoring program currently exists. The PB colony lies approximately in the middle of the NES distribution, but represents a void of data for NES population patterns, behavior, breeding, and other important knowledge otherwise present at other NES sites throughout California, Oregon, and Mexico. This study will establish a population of known individual NES at the Piedras Blancas colony via marking, tagging, and weighing of young-of-the-year, to lay the groundwork for directed studies on known-age individuals, and will initiate non-invasive physiological studies for comparison to animals at Año Nuevo. This project will be the first formal longitudinal study of this population, and will also allow for novel comparisons of behavior and physiology of NES between PB and other known colonies.</p> <p>Sample sizes requested are large to allow for marking and tagging of sufficient proportions of the colony for future studies on known-age individuals. All age classes of animals of both sexes will be taken. Types of takes include behavioral observations and measurements, bioacoustic recordings, marking, flipper tagging, capture, and non-invasive physiological sampling. A total of 64,927 NES will be taken per year for five years: 3,550 handle/release takes, 500 capture/handle/release takes, 1,575 harassment takes, 59,000 incidental disturbance takes, no more than 2 unintentional mortality takes annually (5 for the life of the permit), and 300 export/receive only takes.</p>

Project Description

Purpose: This study will establish a population of known individual NES at the Piedras Blancas colony via marking, tagging, and weighing of young-of-the-year, to lay the groundwork for directed studies on known-age individuals, and will initiate non-invasive physiological studies for comparison to animals at Año Nuevo. This study will also tag young-of-the-year at the emergent colony at Vandenberg Air Force Base so that we can monitor population growth and migration of seals born at this newly established rookery.

Piedras Blancas (PB) in Central California is the site of the largest mainland colony of northern elephant seals (*Mirounga angustirostris*, NES). The colony was established in 1991, currently spans 6 miles of beach, and lies approximately central to the NES distribution. It has grown rapidly over the past three decades since its establishment, yet there has never been a formal population monitoring program at PB and total population estimates have never been published. At nearly all of the other NES-colonized sites, publications have documented rigorous population monitoring methods as well as growth trends since the initial colonization (Allen et al., 1998; Bartholomew and Hubbs, 1960; Le Boeuf et al., 1974; Le Boeuf and Panken, 1977; Mate, 1969; Mesnick et al., 1998; Stewart and Yochem, 1986; Zenkovich, 1998). The PB colony represents a void of data for NES population patterns, behavior, breeding, and additional important knowledge otherwise present at other NES sites throughout California, Oregon, and Mexico.

In the past few years, NES have begun pupping at Vandenberg Air Force Base (VAFB), which lies 14 miles north of Lompoc in central California, approximately 80 miles south of the PB rookery. NES have used these beaches as haul-outs for a number of years, but there were no pups born at this location until December 2016. There were 19 pups born at VAFB in December 2016 and 24 pups born at VAFB in December 2017 (R. Evans and T. Whitsitt, pers. comm.), confirming that this is likely a newly established rookery. Thus, this provides us the unique opportunity to study the population dynamics and behavior of an emergent rookery.

This study is an expansion of a long-term monitoring program that began at University of California Santa Cruz (UCSC) in 1968 at the Año Nuevo NES colony. Over the past 40 years, research at Año Nuevo has provided a wealth of information on northern elephant seal population dynamics, behavior, physiology, and bioacoustics (see LeBoeuf et al., 1994 for a review; Costa et al., 2003; Southall et al., 2003; Ferraro et al., 2017). Although UCSC has permits to conduct research on any rookery within California, their research has primarily focused on the Año Nuevo population. These data have been used to make general inferences about other NES colonies, but the lack of information about other

colonies makes it difficult to know how accurate and applicable these inferences are.

Our research program will investigate many of the same topics as the UCSC research team, but our research will focus primarily on the PB rookery, as there is little scientific information about that colony. This research is crucial in determining the large-scale trends in the NES population, migration between colonies, and how comparable colonies are to one another with respect to factors including demographics, behavior, and physiology. Because the rookery at VAFB is so new and relatively difficult to access, we will focus only on flipper tagging weanlings at that site for now. Although the UCSC team is permitted to work at PB and VAFB, they have neither the means nor the manpower to conduct focused research at those sites. We launched our pilot program under the Costa permit (19108), and Dan Costa has requested that we obtain our own permit so that it can be managed locally (through Cal Poly rather than UCSC). We will continue to actively collaborate with Dan Costa (UCSC) and Dan Crocker (Sonoma State), as well as Gitte McDonald (Moss Landing Marine Laboratories). However, we require our own permit in order to properly manage the research, as well as to cultivate the local relationships with California State Parks, the Friends of the Elephant Seal, and the biologists at VAFB. This is important research to help us better understand the fastest growing northern elephant seal rookery in the entire range, and our team is best situated to accomplish it.

Project Objectives

The primary objective of this project is to establish a long-term research program at the Piedras Blancas and Vandenberg Air Force Base elephant seal rookeries. To do so, we will collect data in three main areas of research: a) population trends, b) basic physiological characteristics, and c) bioacoustics. Our population studies are designed to establish baseline data for future hypothesis-driven research, and the physiological and bioacoustics studies are designed to collect data for direct comparison with studies conducted at Año Nuevo.

a. Population Studies: The overarching goal of the population studies is to provide a large data set for assessing population demographics and migratory patterns of the PB and VAFB rookeries. We will be collecting data on fundamental demographic processes, including survival, reproduction, and the carrying capacity of the rookery. These data will be used to measure and estimating migration, age, birth rates, death rates, life histories of individual animals, local distribution, reproductive histories of individuals, and tag loss data (Bonnell et al., 1978; Reiter, 1984; Le Boeuf and Reiter, 1988; Le Boeuf and Reiter, 1991; Barlow et al., 1993; Lowry et al., 2014). The specific objectives are twofold: (1) to document population growth and movement data for these growing rookeries and (2) to establish a sub-population of known-age individuals that will enable more directed studies in the future.

Hypothesis A1: The population growth rate at Piedras Blancas will slow as the rookery approaches carrying capacity.

Hypothesis A2: The new population at VAFB will exhibit exponential growth over the next several years.

All procedures proposed are based on methods used at Año Nuevo (#19108). At PB, we propose to mark individuals of each age/sex class with temporary hair dye or hair bleach (lasts one year) to easily resight and track individuals to assess mating success, natality, and weaning success. We also propose to flipper tag approximately 1/2 of the number of pups weaned at PB in 2010 (2500 animals), which is estimated to be about 1/4 of the number of pups projected to wean in 2019, on an annual basis. These estimates are based on reports of 4469 pups born at PB in 2010 and an average growth rate of 10.8% per year (Lowry et al., 2014). These are conservative requests, balancing our need to tag a significant proportion of the colony with the feasibility of accessing such a large number of animals. In addition, we propose to flipper tag all of the pups born at VAFB, which we conservatively project to be up to 50 animals each year. This estimate is based on a 26% increase from December 2016 (19 pups) to December 2017 (24 pups), which would yield 30 births in December 2018 at the same growth rate, with 20 additional takes allowing for the likelihood of exponential population growth at this early stage of the rookery's establishment.

Weighing studies of NES weanlings at PB will provide baseline information on average weaning conditions for this population, which is essential information because weaning mass is related to future success and recruitment into the breeding population (Le Boeuf and Reiter, 1988). We will conduct regular ground surveys at PB (at least weekly during the breeding season and at least once per month during the molt) to perform resights of marked and tagged animals, observe behavior of marked animals during the breeding season, estimate pup weaning dates, and track the demographic composition of the beaches throughout the year. We have trained the docents of the Friends of the Elephant Seal to contribute additional resight data as citizen scientists. The biologists at VAFB perform monthly surveys of the rookery there. When possible, we will perform additional surveys during the NES breeding season at VAFB in an effort to increase survey frequency.

Consistency of tagging effort and strengthening of our analyses will be achieved by combining our database with the historical database at UCSC. We are currently collaborating with UCSC for this study under permit #19108, and they are supportive of our efforts to establish an independent research program (D.P. Costa and D.E. Crocker, pers. comm.). Our project will add information about a previously understudied population and will facilitate direct comparisons among study rookeries. We will also share tag resight data with other elephant seal research groups, including researchers at Humboldt State and in Mexico.

b. Physiological Studies. The physiological aspect of this research will provide comparative data for direct comparison to the seals at Año Nuevo. Physiological studies will be focused at PB, where accessibility to the animals is consistent and results in minimal disturbance to non-target species. The two broad categories of physiological research we propose are: i) thermoregulation and ii) kinematics.

Hypothesis B0 (null hypothesis): The thermal physiology and kinematics of NES at PB will be indistinguishable from those of the NES at Año Nuevo. If this hypothesis is supported, we can expect that regional studies on northern elephant seals will be applicable to the greater population.

Hypothesis B1 (alternative hypothesis): The thermal physiology and kinematics of NES at PB will be significantly different from those of the NES at Año Nuevo. If this hypothesis is supported, it will suggest that northern elephant seals have begun to adapt locally at different rookeries, which is scientifically interesting for a species that has been through a severe genetic bottleneck.

i) Thermoregulation: Infrared thermography (IRT) provides a non-invasive method to measure the radiation emitted from an object, which can then be converted to temperature (Codde et al., 2016). IRT will be used to examine general thermoregulatory strategies of the different age classes and sexes of seals during rest and before and after certain behaviors. We will also be using IRT to measure the temperature of certain structures in adults and pups (e.g., the vibrissal system) to establish a more complete understanding of their anatomy and use of thermal windows. We will explore a number of possible research questions, including the thermal effects of territorial behavior in males, the effects of sand flipping on thermal biology, and the ontogeny of vasocontrol.

ii) Kinematics: Male NES must perform burst movements when defending their harems or challenging other males (Stewart et al., 1994), and these movements have recently been shown to be inefficient and costly for the seals (Tennett et al., 2018). We will compare these movements to those of subordinate males (being chased) and adult females (defending their pups) during the breeding season. Four-hour video footage of target animals will be collected three times per week throughout each breeding season to analyze the kinematics of land movements. The frequency, speed, and duration of specific land movements will be measured, particularly those most potentially affected by hypertrophy in fast-twitch oxidative and glycolytic fibers (e.g., chasing or being chased, male-male combat). Analysis of kinematic movements will provide a better understanding of the energetic costs associated with breeding behaviors across the population.

c. Bioacoustic Studies. Our baseline estimates for acoustic studies will be completed by taking source and background sound pressure level (SPL) measurements at the PB colony. (No bioacoustics studies will take place at VAFB for the time being.) This will give us an estimate for the distance over which sounds can be heard over background noise for a

particular environment. Previous studies provide reliable measures of both in-air and underwater critical masking thresholds for pinnipeds (e.g., Southall et al., 2000; 2003), but baseline source level measurements of vocalizations are limited (Schusterman and Moore, 1978; Insley, 1992; Reiman and Terhune, 1993; Sanvito and Galimberti, 2003; Southall, 2003), and have never been studied at the PB rookery. Our research will broaden the database of pinniped acoustics to better understand how natural acoustic disturbances influence NES social ecology.

Hypothesis C0 (null hypothesis): The bioacoustic signals of NES and the influences of those signals on social behavior at PB will be indistinguishable from those observed for NES at Año Nuevo.

If this hypothesis is supported, it will suggest that there are no "dialects" at different rookeries, and animals that move among rookeries will behave similarly with regard to bioacoustic signaling (as senders and receivers).

Hypothesis C1 (alternative hypothesis): The bioacoustic signals of NES and/or the influences of those signals on social behavior at PB will be significantly different from those observed for NES at Año Nuevo.

If this hypothesis is supported, it will suggest that there may be "dialects" at different rookeries, and/or animals may exhibit different behaviors with regard to bioacoustic signaling (as senders or receivers).

i) Passive Acoustics. These studies will utilize passive, non-invasive acoustic measurements on land. This will help us better understand how sounds and vocalizations influence the social behavior of elephant seals at the PB colony. Previous studies have shown that males exhibit individually distinguishable calls, but there may not be "dialects" at different rookeries (Shipley et al., 1981); this work will explore whether that holds true for PB, and will compare sounds of PB animals to those at other rookeries. These data will also be used to assess how exposure to natural acoustic disturbance may disturb northern elephant seals.

ii) Acoustic Playbacks. Our bioacoustics studies will also use acoustic playbacks of vocalizations from all age classes and sexes. These playbacks will help us to better understand the importance of vocalizations in a social context. We will combine these acoustic playback techniques (Insley et al., 2003) with our data from passive acoustic sampling (SPL and vocal structure) to provide a deeper understanding of ecological dynamics.

Description: Overview

The procedures requested have been previously authorized and performed under NMFS Marine Mammal Research Permits #496, #836, #786-1463, #87-1743, #14636, #19108, and their authorized modifications issued to D. Costa. All of the requested activities were approved in similar numbers in permit #19108 and performed without incident by all authorized permittees, including H. Liwanag. The PI (Liwanag) and field leaders have been working with NES at PB for more than 6 months. Liwanag, Weitzner, Voisinnet, and Cooper were trained extensively by researchers at UCSC, where many of the procedures and techniques requested were developed. The present study is modeled after the elephant seal research program at Año Nuevo but will allow new information to be gathered for an important population that has never been formally studied. The proposed methods are the same as those used at Año Nuevo, where there has been no evidence or indication that research efforts have adversely impacted the animals or the colony as a whole (McMahon et al., 2008). For example, research presence at certain areas of the Año Nuevo rookery have not led to decrease in use by seals, and site fidelity has been unaltered by any research activities (P. Robinson, pers. comm.). In the first field season of research at PB conducted by Liwanag under permit #19108, we have documented few incidental takes and have not observed any changes in beach composition or mom-pup separation rates. We expect that by using the same techniques as the Año Nuevo research program we will effectively minimize disturbance of the PB colony.

Animals will be taken primarily during the breeding season (December-April) and periodically during the remainder of the year. Takes will center around the Piedras Blancas elephant seal rookery, which spans 6 miles of beach from Point Piedras Blancas on the central coast of California, located about 40 miles north of San Luis Obispo and 90 miles

south of Monterey. Additional takes will primarily occur at the new rookery at Vandenberg Air Force Base, 14 miles north of Lompoc in central California, approximately 80 miles south of Piedras Blancas. All permitted research activity will be reported to local NMFS authorities as required under normal responsibilities of permit holders. The research team has also established a working relationship with California State Parks, the authority over the land used by NES at PB, and with the Biological Scientist team at Vandenberg Air Force Base. Our target species is not ESA-listed and is not MMPA-depleted.

Our methodology is nearly the same as that of the NES research program at Año Nuevo, but our work is in no way duplicative. The present research team has collaborated closely with Dan Costa's lab at UCSC; though previous permits have included the PB colony, no research has ever been conducted at this colony, with the exception of tag retrieval for studies based elsewhere (D.P. Costa, pers. comm.). The only procedure that has been performed on the seals at PB is the annual flipper tagging of weanlings performed by Brian Hatfield (under Brent Stewart's permit). Hatfield has tagged a small percentage of the population for about 30 years, but has not made the data publicly available. Costa and Hatfield have both supported and endorsed our creation of an independent research program at PB, preventing any potential duplicity of research. Indeed, we will be directly entering our tagging, marking, and resight data into the northern elephant seal database maintained by Costa's lab (and managed through the Smithsonian Institute). Physiological and bioacoustics studies will be performed with the intent of making comparisons to the studies conducted at Año Nuevo.

Research Procedures

All handling techniques conform to standard protocols, and in addition to having MMPA approval, our protocols have already been approved by the California Polytechnic State University Institutional Animal Care and Use Committee (#1711).

Take Category 1: Tagging and marking studies

The main purpose of the initial tagging and marking study is to establish a known population of NES at PB and to provide a foundation for assessing the status of the PB colony relative to the overall NES population. A brand-new rookery was just established at VAFB in December 2016, and tagging any new pups born there would provide a unique opportunity to monitor this rookery nearly from its conception.

2,550 weaned pups of both sexes (approximately 50% of the number of pups born in 2010 at PB, and approximately 25% of the number of pups expected in 2019 (Lowry et al., 2014); plus all of the pups born at VAFB) and 1,000 adults will be tagged with plastic Roto-tags and/or marked with hair dye or hair bleach. Up to 17,750 NES may be incidentally disturbed per year during these activities. The number of incidental disturbances is a conservative estimate (i.e., likely an over-estimate), based on variability in the density of NES on different beaches and at different times.

a. Marking - PB only

The pelage of target animals will be marked using hair dye or hair bleach. Identifying marks (combinations of letters and numbers) are hand-applied to the pelage with a marking stick or via hand-application and is preferentially carried out while the animal is sleeping, causing less disruption. Animals will be marked with letters and/or symbols of minimum size.

Marks are lost during the seasonal molt. Pups younger than 1 week will not be marked or tagged to allow for enough time for the mother-pup bond to form. Similarly, females with dependent pups younger than 1 week will not be marked. Marking and tagging will also not interrupt observable mom-pup interactions, such as nursing or visible bonding behaviors.

b. Tagging - PB and VAFB

Roto-tags (global sheep tag, 5/8 in. wide x 2 in. high, Allflex USA) will be inserted into the interdigital webbing of hind flippers using specialized pliers. Each animal will receive 1 tag in one or both rear flippers. Restraint of animals is typically not required during these activities unless re-tagging or adjustment is necessary. When restraint is necessary, the animal will be manually restrained by hand, hoop net, head bag (mesh bag with soft, breathable material at the apex), or pup bag (canvas bag with a hole at the apex for breathing); this restraint will occur for the minimum time necessary to insert the tag (typically less than a minute). For animals with no flipper tags that are also receiving other treatments involving handling (described below), flipper tags and/or marks will be applied at that time.

c. Resights – PB and VAFB

Ground surveys will be conducted on a regular basis to resight marked and tagged animals, observe behavior of marked animals during the breeding season, and estimate weaning dates of young-of-the-year. These surveys will be conducted on trails overlooking the study beaches, and therefore will not result in incidental disturbance of animals. We will use spotting scopes, binoculars, and/or zoom lenses to identify and observe animals from a distance.

At PB, there are seven distinct beaches included in our regular surveys. We will survey every beach at least once per week during the breeding season, and at least once per month during the annual molt. We have trained the docents of the Friends of the Elephant Seal to contribute additional resight data as citizen scientists; these efforts will be focused at the public viewing beaches (two of the seven study beaches). We will also perform resights on beaches opportunistically, when performing other procedures. This will allow us to obtain additional resights without increasing incidental disturbance for resights alone.

The biologists at VAFB perform monthly surveys of the rookery there. When possible, we will perform additional surveys during the NES breeding season at VAFB in an effort to increase survey frequency.

Take Category 2: Weigh, measure, and sample

These procedures will provide a basis for the anticipated long-term assessment of colony health, reproductive success, parental investment, physiology, behavior, and ecology, and can also be used to measure the effects of climate change and/or other factors. These procedures will only be performed at the PB rookery.

Weanlings will be captured in a specially-designed canvas weigh bag (5'1" long, 3'1" at the opening, 7" across at the nose hole; SLO Sail & Canvas) with a 7" hole at the apex for breathing and a drawstring (rope) at the primary opening to gently cinch the animal in the bag. This bag was designed after the weigh bags currently used at Año Nuevo and was successfully piloted at PB in the 2018 breeding season. The animal's flippers hang out of the bag when the seal is fully inside. 500 weanlings will be captured once annually. This is approximately 10% of the number of pups born annually at PB by 2010 (Lowry et al., 2014). All animals will be handled (restrained, weighed, measured) and released. Up to 20,000 animals may be incidentally disturbed during these handlings. The research team generally targets isolated weanlings or individuals in small groups of weanlings, which results in few incidental disturbances. Occasionally, target weanlings (e.g., animals that were dye-marked and have a known weaning date) are situated in large "pods" of weanlings, and in those cases incidental disturbance numbers are higher.

Weaned pups will be weighed in the weigh bag and suspended from a load-cell scale and carbon fiber tripod. This has been the standard method for weighing pups since 1978 without incident (Reiter et al., 1978; D. Costa, pers. comm.).

Morphometric measurements (girths, standard length, curvilinear length) will be taken using a tape measure, and we will measure dorsal and lateral blubber depth along different points of the body using ultrasound. Animals will also be sampled opportunistically to assess hormonal and/or health parameters (hair clippings, ectoparasites, orifice (ocular, nasal, oral, anal, vaginal) swabs).

Take Category 3: Infrared thermography and kinematics

To assess morphology and thermal properties of elephant seals, infrared thermography (IRT) will be performed with a FLIR infrared thermal camera. Thermal images will be taken at a distance of 1-5 m from the subject. Subjects of IRT must be still, so images are captured primarily while animals are sleeping or resting, causing minimal disturbance. The camera will take simultaneous digital photographs for comparison to thermal images and photogrammetric measurements. These studies will be longitudinal to assess changes during ontogeny and/or seasonally, so we are requesting up to 10 takes per animal to gain an adequate temporal cross-section (e.g., 1 take every 2 weeks throughout the breeding season).

The kinematics of movements on land by seals will be assessed using video footage. Footage will be taken using a DSLR camera or GoPro from a distance. We will gather up to 12 hours of footage each week over the course of the breeding season (December-April). These studies aim to investigate the change in movements throughout the breeding season. Due to the longitudinal nature of the data, we are requesting up to 10 takes per animal.

250 pups (> 1 week)/weanlings and 250 adults of both sexes will be targeted for IRT and kinematics videos. Up to 5,000 animals may be incidentally disturbed during these activities, as procedures will be conducted to preserve natural behavior and therefore minimize disturbance.

Take Category 4: Bioacoustics

Bioacoustics observations and analyses will provide information on the effects of natural sounds on the ecology and behavior of NES. These studies will only be performed at PB, where we have reliable and consistent access to animals with minimal chance of disturbing non-target species. Acoustic measurements will also provide information regarding social communication at PB, for direct comparison to the studies performed at Año Nuevo.

a. Passive Acoustic Sampling

Each year we will obtain source-level recordings of up to 1,000 seals of all ages and sexes. These recordings are non-invasive - with a similar level of disturbance as tag-reading - and are typically measured at a distance of 5-15 m. This distance allows calls to be obtained with minimal background noise while staying below the response threshold distance of the recorded animals. To obtain source-level recordings from specific individuals (e.g., marked animals), recordings will be made with a microphone at a distance of 1 m only when a close approach is possible with minimal disturbance to natural behavior. Only personnel experienced in moving in and around NES will be conducting the acoustic recordings. Up to 5,000 animals may be incidentally harassed during these activities.

Calibrated recordings of aerial vocalizations and baseline noise levels will be made in and around the Piedras Blancas colony. Ambient acoustic recordings will be made to inform initial active space estimates and to quantify fluctuations in activity level. Vocalizations will be recorded for source material for playback, and to obtain source levels for active space estimates as well as to quantify call variability and directivity. Direct measures of aerial vocalization SPL (dB re: 20μPa) will be obtained using a precision sound level meter (Larson-Davis 831, fast response settings). Natural sounds such as ocean surf will also be recorded as source material for playback (sampling rate = 48 kHz; 50Hz-20kHz).

These measurements will be utilized to characterize sounds experienced by the seals, and to calibrate our playback experiments.

b. Acoustic Playbacks

We will complete playback experiments for up to 50 adults and 25 pups (> 1 week)/weanlings of both sexes in each year, which will test recognition abilities and reveal prominent acoustic features in vocal communication. Playback experiments may potentially alter individual seals' behavior, but all playbacks will be brief in nature (?5 minutes) and will never be louder than naturally occurring vocalization source levels. The maximum level for playbacks is 120 dB (Leq) and 130 dB (Lpk) at one meter from the playback speaker; we will not exceed this level, and most playbacks will occur below it. Wherever possible, playback levels will be matched to the actual source level of the recorded caller or sound. For example, male calls average 116 ± 1.5 dB (SPL_{peak}, re: 20uPa; Mathevon et al., 2017), whereas the calls of subadult males, females, and pups tend to be much quieter (80 - 110 dB; SPL_{peak}, re: 20uPa). At the receiver, assuming the closest playback distance of 5 m, received levels from 120 dB playbacks should be < 108 dB (Leq) and 118 dB (Lpk). Although adult male calls are considered to contain impulsive components (Casey et al., 2015), these levels are well below the permanent threshold shift levels for non-impulsive and impulse sounds for phocids, as defined by the U.S. Navy (Navy Technical Guidance, Table C.2.). We expect brief and minimal responses from the seals, if any (e.g., an orientation or call in response but nothing more). The source of the playback speaker will be 5-20 m from the target animal. In most cases, the playback distance will be fixed to 7 m (at 0 degree orientation) to the target animal to allow standardized response measurements to be obtained.

Each playback will be brief (approximately 5 min. maximum duration, including blank intervals between sounds), and may include elephant seal vocalizations and/or natural sounds such as ocean surf as control sounds. Playbacks will not repeated for at least 2 hours on that beach to avoid disruption of normal behavior; therefore, a given beach will likely experience 2 playbacks in a day, and certainly no more than 4 trials in a day. Playbacks to females and pups will only be conducted on individuals on the periphery of a group so that if either moves towards the sound source, they will have a clear/unimpeded path back to their pup/mother. We expect individuals to experience no more than 20 minutes of total maximum playback exposure per 24-hour period.

Playback experiments will only be in air and will be conducted on all age and sex classes at natural SPLs, excluding pups less than one week old and adult females with dependent pups less than one week old. Playbacks will be conducted either directly from a computer or from prerecorded signals. Signals will be broadcast through portable self-amplified speakers (Acoustic Research 40Watt Powered Partners or equivalent) placed within audible range of the test subject (e.g. 5-20 m) at natural call SPLs (measured prior to experiments at 1 m with Larson-Davis sound pressure level meters). All experiments will be recorded on video for detailed scoring in the laboratory.

Behavioral reactions such as orientation, calling, and phonotaxis (i.e., directional movement) will be used in a scoring rubric. Up to 11,250 animals may be incidentally harassed during these activities (approximately 15 animals per target animal).

Non-Target Species and Incidental Harassments

During the combined research activities, up to 59,000 NES may be incidentally harassed annually.

Up to 100 California sea lions, *Zalophus californianus* (CSL), 100 harbor seals, *Phoca vitulina* (HS), and 25 northern fur seals, *Callorhinus ursinus* (NFS) may be incidentally harassed annually during research activities. This could occur if any of the listed species happen to be hauled out near research procedures, though the chance of that occurring is small. CSL, HS, and NFS are not listed as depleted under the MMPA and are not threatened or endangered under the ESA.

Unintentional Mortality or Serious Injury During Research

Maximum number of animals that could die or be seriously injured per year: 5 animals over the life of the permit (not to exceed 2 per year). Incidental mortalities have been extremely rare in this research system and have in almost all cases been associated with pre-existing conditions not evident when choosing the animal. The research program at UCSC experienced the loss of one animal in the last five years during recovery from anesthesia. This animal showed evidence of a fish bone that had perforated the intestine, and the animal had developed sepsis and disseminated intravascular coagulation (DIC) prior to being handled. The animal appeared to be in good health prior to the procedure and provides good evidence of the ability of the species to mask serious health conditions. Every effort is made to select subjects in good health based on coat and mouth color characteristics. However, it is possible that the stress of handling could cause hidden problems to manifest in an animal that otherwise appears healthy; this is why we need to include the possibility of unintentional mortality in our take table, even with our relatively non-invasive procedures. In the event of an injury during a procedure without a vet present, we will call the Morro Bay branch of The Marine Mammal Center, located 25 miles south of the PB field site, where Dr. Heather Harris serves as a contract veterinarian.

In the case of an accidental mortality, blood samples will be collected for chemistry and hematology analysis. The carcass will be secured for a full necropsy by individuals from The Marine Mammal Center (TMMC) in Morro Bay as soon as possible. If it is an adult animal, the carcass would be either buried or allowed to be taken by the tide after the necropsy. If the mortality is a female with a dependent pup, we will notify NOAA and we will actively consult with the marine mammal stranding network (TMMC) to monitor/assess the pup's condition and determine whether the pup is a candidate for rehabilitation or likely to survive as an early weanling. Assessment criteria will include length/width ratio, date of incident relative to peak pupping, and molt status of the coat.

Salvage of Deceased Animals

We will salvage parts of up to 300 animals found dead of natural causes. Muscle and other tissue samples may be collected, sculps (blubber, skin, and hair) for various physiological analyses (detailed under NMFS permit 18523), blood, and milk. Muzzle samples (whiskers and underlying tissue) may be collected for histological analysis of the vibrissal system. For muzzle sampling in particular, adult animals represent a crucial age class for which it is difficult to obtain samples through stranding networks or rehabilitation facilities. Encountering a suitable adult carcass without tissue decay is quite rare; we may encounter one or two such carcasses in an entire year. Therefore, this sampling opportunity is rare and of great scientific importance for the characterization of the vibrissal system, a critically important sensory system in deep-diving seals such as elephant seals.

We will only perform sampling from carcasses when we can avoid being in view of the public during sampling. The salvaged carcasses will be left in their original positions if the carcass and/or sampling marks are not in view of the public. If a carcass is potentially in public view with visible sampling marks, it will be moved to a location (tide line or hidden area of beach) out of view, or buried in the sand for natural decay. We have consulted with the MMHSRP for the region, and have confirmed that we need to perform this sort of sampling ourselves because there is currently no person or organization responsible for handling pinniped carcasses in San Luis Obispo County.

No samples will be imported from outside of the U.S. under this permit. We are proposing local, opportunistic collection of samples. Recipients listed under this permit are U.S.-based researchers. Samples may be exported for analysis under NMFS permit #18523 (Liwanag).

Supplemental Information

Status of Species: Although driven nearly to extinction in the 19th century due to the fur and oil trade, NES have made a remarkable recovery and maintain a vast distribution (Stewart et al., 1994). Hunting brought the population down to an estimated 20-100 individuals on the Isla de Guadalupe, Mexico in 1890. In 1922, the Mexican government, followed shortly by the US government, granted protection of NES, and in the early 20th century the species began to expand their range, with observations documented from San Diego all the way up to Southeastern Alaska (Stewart et al., 1994). Between 1965 and 1991, the annual total population growth rate for NES was 6.3%, and from 1988 to 2010, the U.S. population has grown at an annual rate of 3.8% (Lowry et al., 2014; Stewart et al., 1994). A 2010 estimate put the population of NES in the U.S. and Mexico at between 210,000 and 239,000 (Lowry et al., 2014).

PB in Central California is the site of the largest mainland colony of NES, established in 1991 (Rick et al., 2011). This colony lies approximately in the middle of the NES distribution and has grown rapidly over the past two decades since its establishment, with an annual population growth rate of 10.8%. In 2010, PB was the third largest NES rookery with 4,469 births (Lowry et al., 2014). However, these population estimates have never been published; all PB population monitoring studies and reports have come from Brian Hatfield, whose contribution to NES literature has come in the form of personal correspondence and unpublished data (Lowry et al., 2014; Hatfield and Rathbun, 1999; Rick et al., 2011).

NES, CSL, HS, and NFS are not listed as "endangered" or "threatened" under the ESA nor as "depleted" under the MMPA. For NES, the total fishery mortality appears to be insignificant and approaching a zero mortality and serious injury rate for this stock, and the population continues to grow annually (Carrett et al., 2014a).

Intentional Lethal Take: We are not requesting any intentional lethal take under this permit. If a moribund or starveling orphaned pup is identified, The Marine Mammal Center (TMMC) will be notified. We will work with TMMC to determine whether the pup should be taken for rehabilitation or euthanasia, under their authority, in consultation with Dr. Heather Harris (contract veterinarian for TMMC in San Luis Obispo County). This is how all live response is handled for pinnipeds in this region.

There is a very slim chance of unintentional mortality during handling, and we have included 5 takes for unintentional mortality over the life of the permit, not to exceed 2 mortalities in a single year. Please see attachment for additional details.

Anticipated Effects on Animals: Effects on individuals will be minimal. There is no evidence from the previous research at Año Nuevo or other colonies that these studies would cause severe adverse effects on any individuals or the colony. Animals handled for marking, tagging, and weighing will undergo only a short period (no more than 30 min) of temporary stress associated with capture and/or handling. Decades of flipper tagging on NES at Año Nuevo provide evidence of extremely low risk of infection from flipper tags (<0.5%), and in the rare case of infection the tag is almost always naturally ejected from the flipper (P. Robinson, pers. comm.). Survival rates of animals that have been handled do not vary significantly from untouched controls. We have included up to 2 incidental mortalities to account for the natural survival rate and the chance that we may inadvertently interact with a moribund animal, but we do not expect any of our procedures to cause mortality. Studies conducted on southern elephant seals found no impacts of handling on foraging success (McMahon et al. 2008).

Effects of incidental harassment on non-target animals are minimal as well. Elephant seals acclimate quickly to the presence of researchers and rarely leave the beach. There is neither evidence nor indication that the previous studies at Año Nuevo have adversely impacted individuals or the colony. In our first field season at PB we have had very few incidental takes (fewer than 3,000 individuals) and have not observed any changes in composition or mother-pup bonds on any beaches where we have conducted research. Areas of the rookery with a heavy research presence are well utilized by seals.

Researchers at UCSC found no significant impact of experimental procedures on weaning success, weaning weights, lactation durations, and site fidelity, and these variables were identical for experimental females compared to control animals (D. Costa and P. Robinson, pers. comm.).

Elephant seals are unquestionably the most robust of the pinnipeds to research handling. Animals routinely return to normal behavior shortly after handlings. Animals

remain on shore following most handlings. Surrounding animals rapidly adapt to research presence and continue to sleep and exhibit normal behavior during procedures. Seals not involved in studies do not leave the beach and usually rapidly acclimate to the presence of the researchers. For example, mother/pup pairs adjacent to experimental procedures will most likely continue to sleep and suckle despite the presence of the research activities. Elephant seals are perhaps the most robust marine mammal in this regard.

Measures to Minimize Effects:

Study animals will be chosen carefully to minimize disturbance of other animals in the area. Movement to and from the sampling and observation sites will be done with caution to avoid close contact with any surrounding seals. All personnel leading the described activities are experienced in moving among and around elephant seals. Most visual observations, acoustic recordings, and thermal or other imaging can be made while at a distance from the seals (e.g. 5-50 m) and therefore cause little to no behavioral impact. Procedures requiring closer approaches (e.g., some acoustic recordings at 1 m) will be conducted with abundant caution to preserve natural seal behavior and minimize incidental disturbance. Any takes involving a lactating mother and pup are designed to give mother and pup time to bond and for the mother to demonstrate good maternal behavior before being selected for a study. We will take care to avoid disturbance of females with pups <1 week old, and will only target females and dependent pups located in the periphery of a group, to minimize the potential of separation and to minimize disturbance to other animals. If a dependent pup becomes separated from its mother by more than 5 m during our activities, we will cease activities and actively herd the mother in order to reunite the pair; we will observe the pair an additional 20 minutes after they are successfully reunited to ensure they remain bonded.

All procedures for animal handlings are based on 30 years of similar studies on northern elephant seals at the Año Nuevo rookery. Sterile technique is used to avoid infection, and elephant seals often exhibit open wounds and shark bites in a highly pathogenic environment with low incidence of infection, suggesting a strong innate immune ability. Careful assessment of an animal's health based on condition, coat, and mouth color are made before selection of subjects for procedures involving handling.

The timing of work at VAFB will be carefully planned to minimize the number of incidental harassments of non-target species. We will consult with the scientists at VAFB, Rhys Evans and Tiffany Whitsitt, to get up-to-date information about the study beaches before we conduct any field work at that site. Their survey efforts allow us to monitor numbers of animals on the beach, including California sea lions and harbor seals. We will pay particular attention to the progression of the harbor seal breeding season. To avoid unnecessary incidental harassment and the possibility of maternal abandonment, we will not conduct research activities after the first harbor seal pups are born.

Resources Needed to Accomplish Objectives:

The primary investigator (Liwanag) has experience handling several pinniped species over the last 15 years, including phocid and otariid seals in captivity and in the wild, and thus exhibits sufficient expertise to accomplish the project goals. She was originally trained (as a graduate student) by the Costa lab at UCSC to perform these protocols with northern elephant seals. She has performed the procedures proposed here, including marking, tagging, weighing, morphometrics, infrared thermography, population and behavioral surveys, and animal handling and capture. Liwanag has published 10 peer-reviewed papers on thermoregulation and/or energetics in pinnipeds.

Please see attached document for full Resources Needed to Accomplish Objectives.

Disposition of Tissues: Tissue samples will be stored at Cal Poly in Liwanag's lab until analysis and will be made available for reasonable use to the greater scientific community.

Public Availability of Product/Publications: We expect this flagship study of the PB and VAFB colonies will generate multiple peer-reviewed scientific publications, with undergraduate and graduate students included as active coauthors. The research team will work in cooperation with CA State Parks and the Friends of the Elephants Seal to disseminate information gathered from these studies to the public via docents working at viewpoints and information bulletins. CA State Parks intends to use this information to directly inform their management of the lands as the animals at PB expand to new beaches. One of the primary educational goals of the project is to create an undergraduate course at Cal Poly centered on field work with the PB colony, which will facilitate the perpetual involvement of students in the proposed research.

Location/Take Information

Location

Research Area: Pacific Ocean State: CA

Location Description:

Take Information

Line	Ver	Species	Listing Unit/Stock	Production /Origin	Life Stage	Sex	Expected Take	Takes Per Animal	Take Action	Observe /Collect Method	Procedure	Transport Record	Begin Date	End Date
1		Seal, northern elephant	California Breeding Stock	Wild	Pup/ Juvenile	Male and Female	2550	1	Handle/Release	Other	Mark, bleach ; Mark, dye or paint; Mark, flipper tag; Observation, mark resight; Observation, monitoring; Observations, behavioral	N/A	4/10/2018	10/31/2023
Details: 1.a. Tagging and marking studies. Mark with bleach or dye using wooden marking stick (including dependent pups), tag with plastic rototag, behavioral observations and monitoring. Juvenile = weaned pups up to 3 years.														
2		Seal, northern elephant	California Breeding Stock	Wild	Adult	Male and Female	1000	1	Handle/Release	Other	Mark, bleach ; Mark, dye or paint; Mark, flipper tag; Observation, mark resight; Observation, monitoring; Observations, behavioral	N/A	4/10/2018	10/31/2023
Details: 1.a. Tagging and marking studies. Mark with bleach or dye using wooden marking stick, tag with plastic rototag, behavioral observations and monitoring.														
3		Seal, northern elephant	California Breeding Stock	Wild	All	Male and Female	17750	1	Harass	Other	Incidental disturbance; Observation, mark resight; Observation, monitoring	N/A	4/10/2018	10/31/2023
Details: 1.b. Harassment from 1.a.														
4		Seal, northern elephant	California Breeding Stock	Wild	Juvenile	Male and Female	500	1	Capture/Handle/Release	Other	Mark, bleach ; Mark, dye or paint; Mark, flipper tag; Measure (standard morphometrics); Sample, clip hair; Sample, fecal swab; Sample, nasal swab; Sample, ocular swab; Sample, oral swab; Sample, other; Sample, swab all mucus membranes; Ultrasound;	N/A	4/10/2018	10/31/2023

										Weigh				
		Details: 2.a. Weigh, Measure, and Sample: Capture in canvas bag, weigh and measure, ultrasound, sample (hair, orifice swabs, other=ectoparasites), mark, flipper tag												
5		Seal, northern elephant	California Breeding Stock	Wild	All	Male and Female	20000	1	Harass	Other	Incidental disturbance	N/A	4/10/2018	10/31/2023
		Details: 2.b. Incidental harassment from all 2.a. activities.												
6		Seal, northern elephant	California Breeding Stock	Wild	Pup/ Juvenile	Male and Female	250	10	Harass	Survey, ground	Observations, behavioral; Photogrammetry; Photograph/Video; Remote video monitoring	N/A	4/10/2018	10/31/2023
		Details: 3.a. Infrared thermography and kinematics. Infrared thermography of dependent and weaned pups up to 3 years old, video recordings, photography, behavioral observations.												
7		Seal, northern elephant	California Breeding Stock	Wild	Adult	Male and Female	250	10	Harass	Survey, ground	Observations, behavioral; Photogrammetry; Photograph/Video; Remote video monitoring	N/A	4/10/2018	10/31/2023
		Details: 3.a. Infrared thermography and kinematics. Infrared thermography, video recordings, photography, behavioral observations.												
8		Seal, northern elephant	California Breeding Stock	Wild	All	Male and Female	5000	1	Harass	Survey, ground	Incidental disturbance	N/A	4/10/2018	10/31/2023
		Details: 3.b. Incidental harassment from all 3.a. activities.												
9		Seal, northern elephant	California Breeding Stock	Wild	All	Male and Female	1000	1	Harass	Survey, ground	Acoustic, passive recording; Observations, behavioral	N/A	4/10/2018	10/31/2023
		Details: 4.a. Bioacoustics. Passive acoustic sampling.												
10		Seal, northern elephant	California Breeding Stock	Wild	Pup/ Juvenile	Male and Female	25	10	Harass	Survey, ground	Acoustic, active playback/broadcast; Acoustic, passive recording; Observations, behavioral; Remote video monitoring	N/A	4/10/2018	10/31/2023
		Details: 4.b. Bioacoustics. Acoustic playbacks. Acoustic playbacks of natural calls and novel sounds, recordings, behavioral observations.												
11		Seal, northern elephant	California Breeding Stock	Wild	Adult	Male and Female	50	10	Harass	Survey, ground	Acoustic, active playback/broadcast; Acoustic, passive recording; Observations, behavioral; Remote video monitoring	N/A	4/10/2018	10/31/2023

		Details: 4.b. Bioacoustics. Acoustic playbacks. Acoustic playbacks of natural calls and novel sounds, recordings, behavioral observations.												
12		Seal, northern elephant	California Breeding Stock	Wild	All	Male and Female	16250	1	Harass	Survey, ground	Incidental disturbance	N/A	4/10/2018	10/31/2023
		Details: 4.c. Incidental harassment from 4.b. activities.												
13		Seal, northern elephant	California Breeding Stock	Wild	All	Male and Female	1	1	Unintentional mortality	Other	Unintentional mortality	N/A	4/10/2018	10/31/2023
		Details: 5. Unintentional mortality or serious injury during research; necropsy and collect tissue samples. Total of 5 takes for the life of the project, but up to 2 mortalities allowed in a single year before protocols must cease. NOAA will be contacted ASAP.												
14		Seal, northern elephant	California Breeding Stock	Wild	All	Male and Female	300	10000	Harass/Sampling	Other	Import/export/receive, parts; Salvage (carcass, tissue, parts)	N/A	4/10/2018	11/30/2023
		Details: 7. Salvage and export world wide unlimited elephant seal samples from up to 300 animals (parts including but not limited to: blood constituents, skin, blubber, muscle, vibrissae, and milk).												
15		Sea lion, California	US Stock	Wild	All	Male and Female	100	1	Harass	Other	Incidental disturbance	N/A	4/10/2018	11/30/2023
		Details: 6.a. Incidental disturbance to California sea lions during research.												
16		Seal, harbor	California Stock	Wild	All	Male and Female	100	1	Harass	Other	Incidental disturbance	N/A	4/10/2018	11/30/2023
		Details: 6.b. Incidental disturbance to harbor seals during research.												
17		Seal, Northern fur	Range-wide	Wild	All	Male and Female	25	1	Harass	Other	Incidental disturbance	N/A	4/10/2018	11/30/2023
		Details: 6.c. Incidental disturbance to northern fur seals during research.												

NEPA Checklist

1) If your activities will involve equipment (e.g., scientific instruments) or techniques that are new, untested, or otherwise have unknown or uncertain impacts on the biological or physical environment, please discuss the degree to which they are likely to be adopted by others for similar activities or applied more broadly.

All of our procedures have been successfully performed on elephant seals and do not involve new equipment or techniques.

2) If your activities involve collecting, handling, or transporting potentially infectious agents or pathogens (e.g., biological specimens such as live animals or blood), or using or

transporting hazardous substances (e.g., toxic chemicals), provide a description of the protocols you will use to ensure public health and human safety are not adversely affected, such as by spread of zoonotic diseases or contamination of food or water supplies.

To reduce risk, gloves and other appropriate PPE (lab-coats, eye shields) will be used when handling seals, blood and tissue samples (especially during necropsy). All personnel have been trained in safe animal handling procedures.

3) Describe the physical characteristics of your project location, including whether you will be working in or near unique geographic areas such as state or National Marine Sanctuaries, Marine Protected Areas, Parks or Wilderness Areas, Wildlife Refuges, Wild and Scenic Rivers, designated Critical Habitat for endangered or threatened species, Essential Fish Habitat, etc. Discuss how your activities could impact the physical environment, such as by direct alteration of substrate during use of bottom trawls, setting nets, anchoring vessels or buoys, erecting blinds or other structures, or ingress and egress of researchers, and measures you will take to minimize these impacts.

Our work will overlap with the Piedras Blancas SMCA/SMR, Cambria SMCA/SMP, and Vandenberg SMR. Our activities are limited to the beaches. We will not be directly altering substrate or building structures on the beaches or nearby dunes. We take special care to reduce trail formation when accessing beaches, and we have a zero-waste policy when working on the beaches (i.e., all waste is packed out and properly disposed off site).

4) Briefly describe important scientific, cultural, or historic resources (e.g., archeological resources, animals used for subsistence, sites listed in or eligible for listing in the National Register of Historic Places) in your project area and discuss measures you will take to ensure your work does not cause loss or destruction of such resources. If your activity will target marine mammals in Alaska or Washington, discuss measures you will take to ensure your project does not adversely affect the availability (e.g., distribution, abundance) or suitability (e.g., food safety) of these animals for subsistence uses.

We will be targeting NES in Central California, which does not allow subsistence hunting of marine mammals. None of our sites are eligible for listing in the National Register of Historic Places.

5) Discuss whether your project involves activities known or suspected of introducing or spreading invasive species, intentionally or not, (e.g., transporting animals or tissues, discharging ballast water, use of equipment at multiple sites). Describe measures you would take to prevent the possible introduction or spread of non-indigenous or invasive species, including plants, animals, microbes, or other biological agents.

Our project does not involve activities known or suspected of introducing or spreading invasive species, intentionally or not. All sampling (e.g., hair, orifice swabs, ectoparasites) will involve sterile technique for collection and transport of samples.

Project Contacts

Primary Contact: Heather E Liwanag

Principal Investigator: Heather E Liwanag

Other Personnel

Name	Role(s)
Cameron Cooper	Co-Investigator
Clinton Francis	Co-Investigator
Linnea Erin Pearson	Co-Investigator

Madeline Schroth-Glanz	Co-Investigator
Melissa Voisinet	Co-Investigator
Emma Weitzner	Co-Investigator

Attachments

- Certification of Identity - (Added Apr 25, 2018)
- Contact - Cameron Cooper (Added Apr 25, 2018)
- Contact - Clinton Francis (Added Dec 11, 2018)
- Contact - Emma Weitzner (Added Jan 19, 2017)
- Contact - Emma Weitzner (Added Feb 20, 2017)
- Contact - Emma Weitzner (Added Apr 25, 2018)
- Contact - Emma Weitzner (Added Oct 2, 2018)
- Contact - Heather E Liwanag (Added Apr 25, 2018)
- Contact - Heather E Liwanag (Added Jul 28, 2018)
- Contact - Linnea Erin Pearson (Added Feb 20, 2017)
- Contact - Linnea Erin Pearson (Added Feb 20, 2017)
- Contact - Madeline Schroth-Glanz (Added Oct 2, 2018)
- Contact - Madeline Schroth-Glanz (Added Dec 11, 2018)
- Contact - Melissa Voisinet (Added Feb 20, 2017)
- Contact - Melissa Voisinet (Added Apr 25, 2018)
- Contact - Melissa Voisinet (Added Jul 25, 2016)
- Contact - Melissa Voisinet (Added Jan 23, 2017)
- Project Description - (Added Dec 11, 2018)
- Project Description - (Added Dec 11, 2018)
- Project Description - (Added Dec 11, 2018)
- Project Description - (Added Dec 11, 2018)
- References - (Added Dec 11, 2018)
- Resources Needed - (Added Dec 11, 2018)

Status

Application Status:	Application Complete
Date Submitted:	December 11, 2018
Date Completed:	October 4, 2018
FR Notice of Receipt Published:	December 26, 2018 Number: 2018-27870
Comment Period Closed:	February 25, 2019 Comments Received: No Comments Addressed: No
Last Date Archived:	April 10, 2019

- MMPA Research/Enhancement permit

Current Status: Issued **Status Date:** April 10, 2018

Section 7 Consultation: N/A

NEPA Analysis: Categorical Exclusion

Expire Date: March 31, 2024

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Modification Requests

Reports

Nbr	Report Type	Reports Required		Date Due	Status	Date Received
		Start Date	End Date			
1	Annual	04/10/2019	03/31/2020	06/30/2020	N/A	
2	Annual	04/01/2020	03/31/2021	06/30/2021	N/A	
3	Annual	04/01/2021	03/31/2022	06/30/2022	N/A	
4	Annual	04/01/2022	03/31/2023	06/30/2023	N/A	
5	Combined Annual/Final	04/01/2023	03/31/2024	06/30/2024	N/A	